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Indian Standard

IS 11328 : 2022

सेल्फ-कंटेंड आटोमेटिक आइस मेकर्स — विशिष्टि

(पहला पुनरीक्षण)

Self-Contained Automatic Ice Makers — Specification

(First Revision)

ICS 97.130.20

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Refrigeration and Air Conditioning Sectional Committee, MED 03

FOREWARD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Refrigeration and Air Conditioning Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1985.

The first revision has been taken up to keep pace with the latest technological developments and international practices. The major changes in this revision are as follows:

a) The scope of the standard has been revised;

b) New terminologies have been added;

c) Construction requirement has been elaborated;

d) Refrigerating system requirement has been incorporated; and

e) Requirement for electrical equipment have been elaborated.

The composition of the committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SELF-CONTAINED AUTOMATIC ICE MAKERS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard prescribes the general construction and performance requirements of automatic ice makers working on vapor compression refrigeration principle for rated voltage up to and including 250 V, 50 Hz, for single-phase and up to and including 440 V, 50 Hz for three-phase. The standard prescribes rating and test requirements for ice makers for commercial or similar use.

1.2 This standard does not cover the following:

a) Refrigeration system with water cooled (or remote) condensing unit; and
b) Ice maker installed as part of household refrigerator.

2 REFERENCES

The standards listed below contain provisions, which through reference in this text constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
661 : 2019	Thermal insulation of cold storage — Code of practice (*fourth revision*)
732 : 2019	Code of practice for electrical wiring installations (*fourth revision*)
996 : 2009	Single phase a.c. induction motors for general purpose (*third revision*)
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium — Specification (*third revision*)
10617 : 2018	Hermetic compressors — Specification (*second revision*)
12615 : 2018	Line operated three phase a.c. motors (IE Code) “Efficiency classes and performance specification” (*third revision*)
16678 (Part 2) : 2018/ ISO 5149-2 : 2014	Refrigerating systems and heat pumps — Safety and environmental requirements : Part 2 Design, construction, testing, marking and documentation

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Automatic Commercial Ice-Maker — Factory-made appliance consisting of a condensing unit and ice-making section operating as an integrated unit, with means for making and harvesting ice, also including means for storing or dispensing ice, or both.

NOTE — Ice makers are intended to produce ice in irregular shapes or flakes or ribbons or wafers as well as uniformly shaped ice cubes.

3.2 Self Contained Unit — A unit in which ice making compartment and the storage compartment are integral and form a single unit in a single cabinet.

3.3 Split System Unit — A unit in which condensing unit and ice making unit are in separate sections (or cabinet). The condensing unit and the ice making section are connected by refrigerant piping.

3.4 Storage Compartment — The part of the refrigerator meant for ice storage.

3.5 Thermal Insulation — A material of low thermal conductivity employed for the purpose of retarding heat flow.

3.6 Ice Making Rate — The amount of ice produced, in kg/24 h. The temperature of ice produced should be 0ºC or less.

3.7 Potable Water use Rate — The amount of potable water used in making ice, stated in litre/kg of ice.

3.8 Energy Consumption — Total energy consumption stated in kWh/kg of ice produced as per **7.6.4**. For split units, total energy should also include condenser side power.

3.9 Harvesting Cycle — The cycle consists of ice making cycle for 24 h from initiation of ice formation.

3.10 Ice Cube — Single piece of ice that can have different shapes (for example, dice, cylinder, ball, etc).

3.11 Nugget — Single piece of ice produced by a continuous ice maker.

3.12 Ice Flakes — Ice which residual water is less than 30 percent of the mass of the ice.

3.13 Ice Storage Bin — Factory-made container (not necessarily shipped in one package) that forms or is intended to form a non-refrigerated compartment for the storage of ice.

3.14 Separate Storage Compartment — Non-refrigerated compartment for the storage of ice that is separate from the ice-making mechanism.

3.15 Purge (Blow-Down) — Dissipation of a certain percentage of water to control the clarity of ice or to prevent scaling.

3.16 Batch Type Ice Maker — An ice maker having alternate freezing and harvesting period.

3.17 Continuous Type — An ice maker which continuously freezes and harvests ice simultaneously.

4 CONSTRUCTION

4.1 General

The ice maker and its parts shall be constructed with the strength and rigidity adequate to normal conditions of handling, transport, and usage. There shall be no sharp edges or corners liable to cause injury under normal conditions of use. Also, under normal usage, all moving parts which constitute an accident hazard shall be effectively guarded. The ice maker shall be constructed to have an assembly design that permits the removal of any defective part and its easy replacement.

4.2 Materials

Materials used in the construction of the cabinet shall comply with Indian Standards wherever applicable, except when such requirements are modified by this standard. They shall be free from defects that are liable to cause undue deterioration or failure. Under normal conditions of use, the materials used shall not shrink, warp or cause mold or odours, and shall be resistant to attack by local vermin and destructive pests. Where liable to be exposed to moisture, chemically active substances, food or food products, they shall be suitably resistant and shall not contaminate stored products placed in contact with them. Sealing materials used shall not lose in service any of their essential properties, such as adhesion, plasticity, and moisture resistance due to ageing, temperature, and humidity variations.

4.3 Internal and External Finishes

Internal and external finishes shall be durable and capable of being cleaned effectively and hygienically without undue deterioration. All metal parts used inside the ice maker or on the outside where they are exposed to moisture or the ambient conditions shall be corrosion-resistant or adequately protected against corrosion.

4.3.1 Electroplated metal parts used in the cabinet shall satisfy the requirements specified in IS 1068.

4.3.2 Where vitreous enameled parts are fitted, ample means shall be provided to prevent chaffing or mechanical stress likely to cause chipping. Where liable to contact with food products or other chemically active substances, the enamel shall be suitably resistant.

4.4 Thermal Insulation

The quality, thickness, and application of the insulation material shall be such that efficient insulation of the cabinet is reasonably maintained. There shall be proper seals against moisture penetration by diffusion or condensation. Detachable plates and covers shall be provided with suitable seals to prevent the ingress of moisture into the insulation. Highly conducting external or internal surfaces shall be separated by insulating breaker strips or their equivalent. As far as possible, no member of the frame shall penetrate the full thickness of the insulation. The external surface of the cabinet shall be free from condensation under normal conditions of service.

NOTE — IS 661 may be referred for recommended thicknesses of insulation.

4.5 Fittings

Linings and facings shall have sufficient mechanical strength to resist distortion and give reasonable protection to the insulation. There shall be no infiltration of solid objects from the door gaskets or any other openings.

4.6 Hardware

Door fasteners and hinges shall be smooth and positive in action and designed to maintain their proper function without undue wear under normal conditions of service. Screws and all hardware shall be of brass or other corrosion-resisting material.

4.7 Water Condensation

Suitable means shall be provided to prevent moisture dripping or splashing from baffles, drip trays, or other cold parts on the articles placed on the shelves.

4.8 Harvesting

Means shall be provided for collecting all the water from the evaporator either by a removable tray or by a fixed receptacle. The suitable arrangement shall be made for the elimination of water and, where necessary, suitable means shall be provided for heating the tray for preventing freezing of water.

4.9 Drains

Where drains are fitted they shall have ample capacity to cope with the requirements of normal service and shall be suitably sealed against ingress of air. They shall also be accessible for cleaning and shall not allow water to collect.

4.10 Interior Fittings

Rails and shelves if applicable shall be sufficiently strong for the duty required. Unless specified otherwise, the maximum height of any shelf shall be 1.5 m (or 5 ft.) from the floor level and the depth of a shelf shall be not more than 0.75 m.

4.11 Compressor

The compressors shall conform to IS 10617.

4.12 Motors

The motor used for driving the fan/blower motor shall be either capacitor type induction motors or brushless d.c. motor (BLDC).

The capacitor type induction motor shall comply with the requirements given in IS 996 as applicable for fan duty motors.

In the case of BLDC motors, the test for full load test shall be carried out at the rated frequency declared by the manufacturer. The measured power input and the speed shall be within ± 10 percent of the declared value. In addition, BLDC motors shall comply with the following requirements as specified in the respective clauses of IS 996 as applicable:

a) Dimensions (*see* **7.1**);
b) Terminal box (*see* **9.2**);
c) Mounting (*see* **9.3**);
d) Constructional features (*see* **9.4**);
e) Enclosure (*see* **10** of IS 996 and IP code as per IS/IEC 60529);
f) Method of cooling (*see* **11**);
g) Full load test for measurement of power input and full load speed at the declared frequency (*see* **12.5** and **F-6.2.4**);
h) Insulation resistance excluding the requirement of temperature rise test (*see* **12.7**);
j) High voltage (*see* **13.1**); and
k) Moisture proofness (*see* **13.2**).

NOTE — Separate standard for BLDC motor is under development. Requirement of overload protector, the centrifugal switch and capacitor from IS 996 does not apply for BLDC motor.

5 REFRIGERATING SYSTEM

5.1 Construction

Pipes and connections to moving or resiliently mounted parts shall be and arranged as not to foul, or transmit vibrations to other parts. Pipes and connections shall be securely fixed and sufficient free length shall be provided to minimize the risk of failure due to fatigue. Where necessary for normal operating conditions, pipes and valves shall be thermally insulated. The refrigerating system shall be free from undue noise or vibration.

5.1.1 The evaporator may be of copper, brass, or aluminium. Copper evaporator shall be hot-dip tinned, electro-tinned, or oxidized. Stainless steel may also be used for this purpose.

5.2 Water Condensation

Suitable means shall be provided to prevent. Water condensed on cold parts or pipes of the refrigerating system from affecting the operation of the unit of its controls.

5.3 Safety Features in Design

The refrigerating system shall be assembled in accordance with good engineering practice and shall meet the requirements laid down in IS 16678 (Part 2)/ISO 5149-2. The refrigerating system shall be so designed that it will suffer no damage if the door of the cabinet is left open accidentally in ambient air or if the unit starts with high pressure on the low side. When the door is left open under normal operating conditions, the automatic motor overload protective device may come into operation.

5.4 Control of Operation

Refrigerant flow and compressor driving motor operation shall be automatically controlled to control the quantity of ice produced as per the designed capacity of the machine and to maintain it within the limits of application. Strainer and dehydrator shall always be provided in the liquid line.

5.5 Location of the Components

The evaporator, screens, baffler, drip tray, etc, shall not obstruct access to the stored products. All control devices and service valves shall be readily accessible. Where the evaporator incorporates facilities for making ice, ice-trays shall be capable of being removed without disturbing the stored products.

5.5.1 *Fixing of the Evaporator*

Evaporator shall be fixed on suitably insulated supports.

6 ELECTRICAL EQUIPMENT

6.1 Motors

All motors shall be of types suitable for their particular applications. Motors shall conform to the requirements of IS 12615 or IS 996 whichever is applicable as per **4.12**.

6.2 Motors shall be adequately protected against dangerous over-heating arising from the excessive flow of current.

6.3 Motor Starters, Relays, Thermostat, Controls, etc

All switching devices in the main motor circuit shall be capable of breaking the stalled current of the motor. Switching devices shall be so designed or located that they are not affected by moisture during normal use. They shall be suitable for operation at the applied voltage. Suitable types of radio interference suppressors shall be fitted, where required.

6.4 Wiring

Electrical wiring and connections shall conform to the requirements of IS 732, and also the *Indian Electricity Act,* 1910 and *Indian Electricity Rules*, 1956. All electrical joints shall be electrically and mechanically secure. Where any wire or cord passes through metal holes, the metal edges shall not have sharp edges. The cord entry shall be provided with protection with rubber pieces or similar alternate protection, for example as shown in Fig. 1, to protect the cord from damage, if there are any sharp edges.

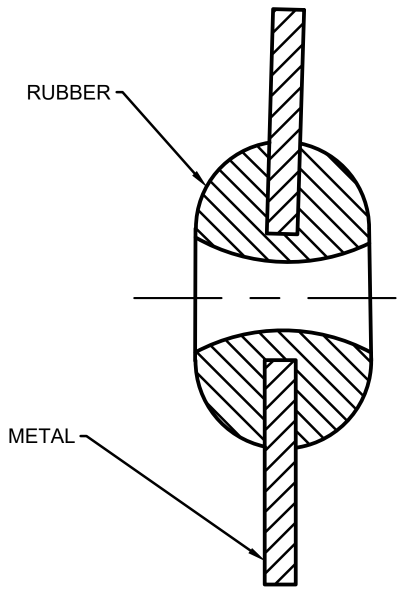


FIG. 1 RUBBER PROTECTION FOR CORD

6.4.1 Live parts shall be protected by suitable guards, shields, or screens of adequate strength and durability to avoid the possibility of making inadvertent contact therewith during normal service conditions.

6.4.2 The entry to the cabinet for refrigerant pipes, electrical wires, and thermo-static capillary tubing shall be provided with protection against moisture ingress.

6.5 Electrical Accessories

All internal electrical fittings, such as lamps, switches, fans, etc, shall be provided with guards for protection against mechanical damage.

6.6 Earth Connection

The metal sheathing of the cables and the metal casings of the electrical components shall be assembled and bonded to ensure earth continuity and connected to a suitable earth terminal. The metal frame or chassis of the ice maker cabinet shall be suitably earthed.

7 TESTS

7.1 General Requirements for Tests

7.1.1 *Test Conditions*

7.1.1.1 The ice maker shall be so placed or shielded to prevent direct radiation from the heating equipment or other sources of heat. Air circulation in the test room shall be such that the specified uniformity of temperature distribution is obtained without a direct draught upon the ice maker under test. The ice maker shall be shielded from extraneous air currents, which exceed 15 m/min. The machine shall be placed on a wooden platform with a solid top. The vertical ambient temperature gradient in the test room to a height of 2 m shall not exceed 1 K/m.

7.1.1.2 The interior of the cabinet shall be dried prior to start of the tests.

7.1.1.3 The cabinet door or doors shall be kept closed during each test.

7.1.2 *Temperatures*

7.1.2.1 *Ambient temperatures*

a) The ambient temperature shall be maintained at 32°C to within ±1°C of the specified value and shall be measured at 300 mm from the sides and front of the cabinet and at the height of the geometric centre of the front and sides. This condition shall be maintained during both stabilizing and test periods;
b) The ambient temperature shall be recorded at one of the above positions, with a recording instrument. If an indicating instrument is used, readings shall be taken at intervals of 5 min; and

c) The vertical temperature gradient from the floor to a height of 2 m shall not exceed 1.0°C for each m of vertical distance.

See Fig. 2 at Annex A for thermocouple location.

NOTE — Ambient sensor shall be shielded from any source or sink of radiant heat which influence measurement air temperature, including conditioning equipment, external doors, or appliance under test.

7.1.3 *Electric Power Supply*

7.1.3.1 In all tests, the supply voltage shall be within 2 percent of the following:

a) The voltage marked on the nameplate; or
b) The mean if the maximum and the minimum range is marked on the nameplate.

7.1.3.2 The supply frequency in the case of a.c. shall be within ±1 percent of the frequency marked on the nameplate.

7.1.4 *Instruments and Measurements*

7.1.4.1 Temperature measurements shall be made with instruments being accurate to 0.5°C.

7.1.4.2 Pressure measurements, when taken, shall be made with Bourdon tube gauge or electrical transducer. The accuracies of measurement shall be ±1 percent of reading.

7.1.4.3 Watt-hour meter shall be capable of being read up to 0.01 kWh with 1 percent of reading accuracy.

7.1.4.4 The operating time of the unit shall be obtained by means of a recording meter or a self-starting synchronous electric clock.

7.1.4.5 Water inlet temperature shall be 30 ± 1°C and the water pressure should be maintained as specified by the manufacturer.

7.2 Ice Weighing Instruments

Ice shall be weighed on an instrument having an accuracy and readability of ±1 percent of the quantity measured. The intercepted ice shall be obtained in one of the following containers of predetermined mass:

a) Perforated pan, bucket or wire basket; and
b) Non-perforated pan or bucket.

7.3 Type Tests

The following shall constitute the type tests:

a) Capacity/ice making tests;
b) Water consumption tests;
c) Energy consumption test;
d) Product density test/ice quality measurement; and
e) Maximum operating conditions test.

7.4 Routine Tests

Every commercial ice maker after production completion shall be subjected to the following routine tests as per IS 302 (Part 1) at the manufacturer's works which shall be carried out without loading the ice maker:

a) Leakage current test — The leakage current shall not exceed 3.5 mA at rated voltage (*see* **13.2**);
b) Earth continuity test (*see* **A-1**); and
c) Electric strength test (*see* **A-2**).

7.5 Acceptance Tests

If the purchaser desires any of the production routine tests. The tests, then where agreed to between the purchaser and the manufacturer, the tests specified in **7.3** is to be repeated at the manufacturers' works.

7.6 Test Procedure

7.6.1 *Stabilization*

Before the measurement period, the unit should be stabilized.

The ice maker shall be considered stabilized after five consecutive ice production capacity measurements for batch type ice makers and after a period of not less than two hours of operation for continuous type ice makers.

7.6.2 *Capacity Test/Ice Making Test*

The test shall be conducted as follows:

a) The test for batch-type ice makers shall start at a pre-selected point in a cycle and shall continue for 3 complete cycles, ending at the same point in the cycle. One cycle consists of freezing and ice-making (harvesting);
b) A perforated container, pre-weighed and pre-cooled to less than or equal to ice temperature shall be used;
c) For continuous ice makers, the test shall run for 1.5 h, during which time, the ice shall be intercepted for three periods of 15 min each; and
d) A non-perforated container pre-weighed and pre-cooled to less than or equal to ice temperature shall be used.

The ice making capacity in kg per 24 h shall be equal to or greater than 90 percent of the rated capacity during the test period.

7.6.3 *Water Consumption Test*

The test shall be conducted as follows:

a) The water consumption shall be determined for the same periods as described in **7.6.2** a) or c); and
b) The water consumption in litres per kg of ice is to be calculated from consumption measured during the test period.

The water consumption shall not exceed the rated water consumption by 10 percent.

7.6.4 *Energy Consumption Test*

The test shall be conducted as follows:

a) The total energy consumption (kWh/kg) shall be measured for the unit during the test period (including ice making and condensing section); and
b) The total energy consumed in making and storing the ice, excluding dispensing or other energy-consuming elements shall be excluded.

The energy consumption shall not exceed the rated energy consumption by 10 percent.

7.6.5 *Ice Quality Measurement by Method of Calorimetry*

7.6.5.1 *Instrumentation*

The instruments accuracy shall be within the following limits:

a) Weighing scale, accurate to ±2 g, with a range of at least 0 to 25 kg;
b) Temperature measuring instrument for water, accurate to 0.8°C with a range of at least – 1°C to 50°C and a resolution of at least one tenth of a degree;
c) Temperature measuring instrument for room (ambient) temperature, accurate to 0.8°C, with a range of at least – 1°C to 40°C and a resolution of at least one degree; and
d) Timer readable to the nearest second.

7.6.5.2 *Procedure for calorimeter constant determination*

The verification of the calorimeter constant of the apparatus used to determine specific heat of fusion for the ice product is to correct for the effects of heat transfer with ambient and heating effect of stirring the contents of the calorimeter.

The test shall be conducted as follows:

a) The room temperature shall be maintained within a range of 18°C to 24°C during the entire procedure;
b) The empty calorimeter shall be weighed and recorded;
c) A quantity of water that is 5 times the mass of the ice to be added as in subclause e), ±60 g and that has a temperature 10°C ± 1°C above room temperature. The water temperature and the combined weight of the calorimeter and water shall be recorded;
d) It shall be stirred at 1 ± 0.5 revolutions per second for 15 min and the water temperature and room temperature just prior to the addition of the ice shall be recorded;
e) Within 1 min, a mass of ice that is within a range of 50 percent to 200 percent of the rated ice production for a period of 15 min of the ice maker to be tested shall be added, or 2.5 kg ± 150 g, whichever is less, in the form of a single block of pure ice that has been allowed to reach an equilibrium temperature measured by a thermocouple embedded in the interior of the block of 0°C and is free of trapped water, recording the time when all ice has been added to the nearest second;
f) It shall be stirred at the same rate as in d), recording the water temperature, room temperature, and the time (to the nearest second) when the ice disappears. Continue stirring at a constant rate after the ice has disappeared for a period of 15 min and record the water and room temperature at the end of the 15 min period. The calorimeter with the water and the melted ice shall be recorded;
g) The calorimeter constant shall be determined following the steps and calculations in Table 1; and
h) The calorimeter constant shall be determined at minimum each time the temperature measuring and weighing instruments are calibrated or when there is any change to the container or stirring apparatus.

The calorimeter constant shall be in the range of 1.0 to 1.02 for use in determining calorimetry of harvested ice. Apparatus improvements are needed if the constant falls outside this range.

7.6.5.3 *Procedure for determining net cooling effect of harvested ice*

The test shall be conducted as follows:

a) Room temperature shall be maintained within a range of 18°C to 24°C during the entire procedure;
b) The empty calorimeter shall be weighed and recorded;
c) A quantity of water that is 5 times the weight of ice to be added as in subclause **7.6.5.2** e) ± 60 g, and that has a temperature 10°C ± 1°C above room temperature. The water temperature and the combined weight of the calorimeter and water shall be recorded;
d) It shall be stirred at 1 ± 0.5 revolutions per second for 15 min and the water temperature and room temperature just prior to the addition of the ice shall be recorded;
e) The quantity of harvested ice that has been used for **7.6.5.2** e) shall be added. It shall be stirred at 1 ± 0.5 revolutions per second, recording the minimum water temperature;
f) The calorimeter with the water and the melted ice shall be recorded; and
g) The results as indicated in Table 2 shall be calculated.

Table 1 Calorimeter Constant

(*Clause* 7.6.5.2)

Sl No.	Data to be Recorded	Units	Data Recorded Trail 1	Data Recorded Trail 2
(1)	(2)	(3)	(4)	(5)
i)	Weight of the calorimeter	kg		
ii)	Water temperature after addition of the calorimeter	°C		
iii)	Combined weight of the calorimeter and water	kg		
iv)	Weight of the water = (iii) – (i)	kg		
v)	Room temperature at time ice is added	°C		
vi)	Water temperature at time ice is added	°C		
vii)	Time that ice is added	min		
viii)	Time when ice is completely melted	min		
ix)	Room temperature when ice is completely melted	°C		
x)	Water temperature when ice is completely melted	°C		
xi)	Combined weight of calorimeter, water, and added ice	kg		
xii)	Weight of ice = (xi) – (iii)	kg		
xiii)	Room temperature after second 15 min stirring	°C		
xiv)	Water temperature after second 15 min stirring	°C		
xv)	Temperature drop of water = (vi) – (x)	°C		
xvi)	Refrigeration used to cool the water = (xv) x (iv) x 4.19 kJ/ °C; [(xv) x (iv)]	kJ		
xvii)	Average temperature difference between room and water during second 15 min stirring = [(ix) + (xiii) – (x) – xiv)]/2	°C		
xviii)	Temperature rise during second 15 min stirring = (xiv) – (x)	°C		
xix)	Heat gain conductance factor = (xviii) – 4.19 kJ/ °C – kg x [(xii) + (iv)]/ [(xvii) × 15 min]; {(xviii) × [(xii) + (iv)]/[(xvii) × 15 min]}	kJ/ min/ °C		
xx)	Average temperature difference between room and water during ice melt period = [(ix) + (v) – (vi) – (x)]/2	°C		
xxi)	Ice melt duration = (viii) – (vii)	min		
xxii)	Ice melt period heat gain = (xix) × (xx) × (xxi)	kJ		
xxiii)	Total cooling effect = (xvi) + (xxii)	kJ		
xxiv)	Sensible cooling from ice melt water = (xii) × (x) × 4.19 kJ/ kg –°C; {(xii) × [(x) – 32 °F]}	kJ		
xxv)	Heat of fusion = (xxiii) – (xxiv)	kJ		
xxvi)	Specific heat of fusion = (xxv)/(xii)	kJ/kg		
xxvii)	Average specific heat of fusion for trial 1 and trial 2	kJ/kg		
xxviii)	Calorimeter constant = 335 kJ/kg/(xxvii)			

NOTE — Numbers in parentheses in the calculation equations in the above steps refer to the numbers determined in each step.

Table 2 Net Cooling Effect for Ice Sample

(*Clause* 7.6.5.3)

Sl No.	Data to be Recorded	Units	Data Recorded Trail 1	Data Recorded Trail 2
(1)	(2)	(3)	(4)	(5)
i)	Weight of the calorimeter	kg		
ii)	Water temperature after addition of the calorimeter	°C		
iii)	Combined weight of the calorimeter and water	kg		
iv)	Weight of the water = (iii) – (i)	kg		
v)	Room temperature at time ice is added	°C		
vi)	Water temperature at time ice is added	°C		
vii)	Time that ice is added	min		
viii)	Time when ice is completely melted	min		
ix)	Room temperature when ice is completely melted	°C		
x)	Water temperature when ice is completely melted	°C		
xi)	Combined weight of calorimeter, water, and added ice	kg		
xii)	Weight of ice = (xi) – (iii)	kg		
xiii)	Temperature drop of water = (vi) – (x)	°C		
xiv)	Refrigeration used to cool the water = (xv) × (iv) × 4.19 kJ/ °C; [(xv) × (iv)]	kJ		
xv)	Heat gain conductance factor from calorimeter constant determination [(item (xix) in Table 1]	kJ/ min/ °C		
xvi)	Average temperature difference between room and water during ice melt period = [(ix) + (v) – (vi) – (x)]/2	°C		
xvii)	Ice melt duration = (viii) – (vii)	min		
xviii)	Ice melt period heat gain = (xix) × (xx) × (xxi)	kJ		
xix)	Total cooling effect = (xvi) + (xxii)	kJ		
xx)	Sensible cooling from ice melt water = (xii) × (x) × 4.19 kJ/ kg – °C; {(xii) × [(x) – 32 °F]}	kJ		
xxi)	Heat of fusion = (xxiii) – (xxiv)	kJ		
xxii)	Specific heat of fusion = (xxv)/(xii)	kJ/kg		
xxiii)	Average specific heat of fusion for trial 1 and trial 2	kJ/kg		
xxiv	Net cooling effect/ mass = 23 x calorimeter constant	kJ/kg		
xxv)	Ice hardness factor = [(xxiv)/(xxii)] × 100	Percent		

NOTE — Numbers in parentheses in the calculation equations in the above steps refer to the numbers determined in each step.

The net cooling effect/mass shall not be less than 90 percent of declared value.

7.6.6 *Maximum Operating Conditions Test*

This test should be carried out at an ambient of 43 ± 1°C. The units shall run continuously for minimum period of 2 h without any abnormal failure.

The compressor might trip during the operation of the unit with over load protector (OLP). However, the appliance should not become unsafe with regard to electric shock, fire hazard, mechanical hazard or dangerous malfunction.

8 MARKING

8.1 Each ice maker shall have the following information marked on a nameplate in a permanent and legible manner in a location where it is accessible and easily visible after installation:

a) The name and address of the manufacturer;

b) Type, model, and serial number;

c) Normal running current, voltage of the supply circuit, and in the case of a.c., the frequency for which the ice maker is designed;

d) The name and the maximum weight of the refrigerant used and of any warning agent that has been added; and

e) Ice harvesting capacity in kg/24 h.

8.2 Information to be supplied by the Manufacturer

The manufacturer or the supplier shall also provide information regarding the following:

a) Operating instructions;

b) Ice capacity; and

c) Water consumption capacity.

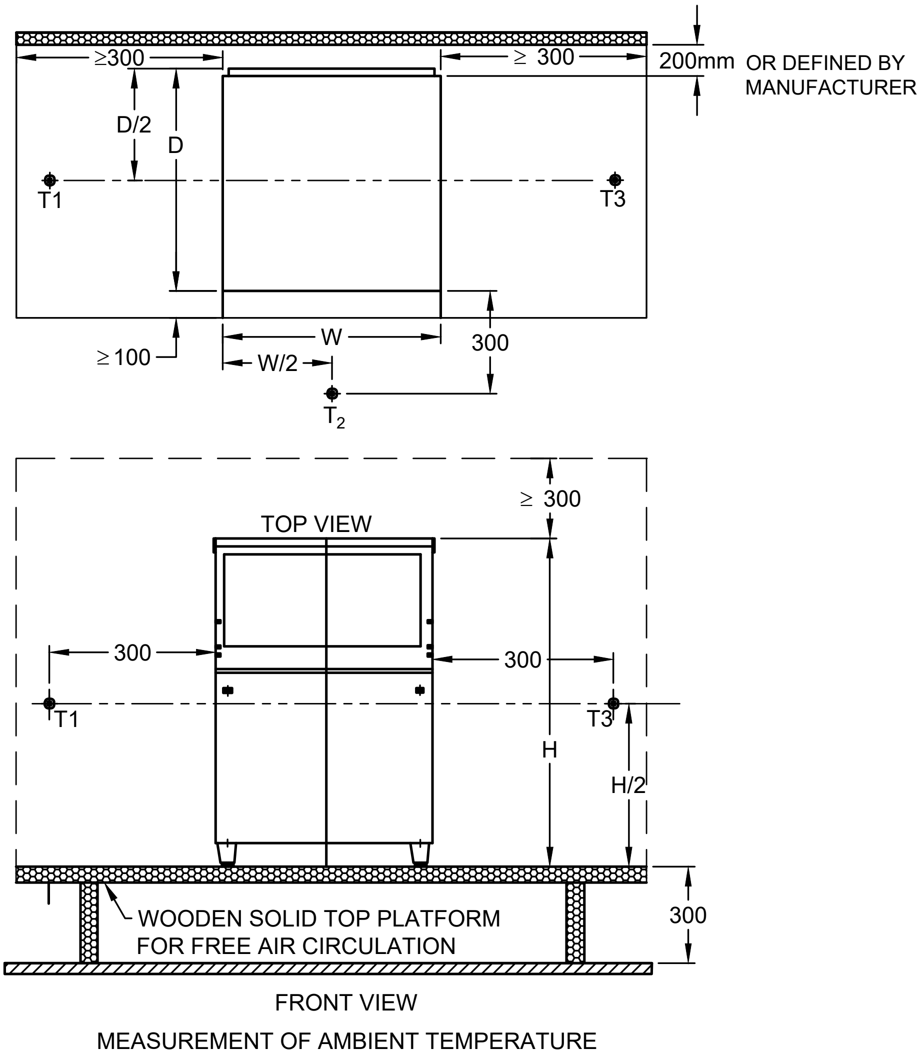
8.3 BIS Certification Marking

The product conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed there under, and the product may be marked with the Standard Mark.

ANNEX A

(*Clause* 7.1.2.1)

AMBIENT TEMPERATURE MEASUREMENT AND SOLID TOP PLATFORM LOCATION



NOTES

1 T1, T2, T3 ambient measurement sensor's location. All dimensions are in mm. Tolerance on dimensions are ± 10 mm.

2 Ambient sensor shall be shielded from any source or sink of radiant heat which influence measurement of air temperature, including conditioning equipment, external doors, or appliance under test.

Fig. 2 Thermocouple Location

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Refrigeration and Air Conditioning Sectional Committee, MED 03

Organization	*Representative(s)*
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